Installation & Maintenance Data

IM 474-3

Group: **Controls**

Part Number: **573897Y**

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MicroTech®
Open Protocol Master Panel

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Introduction

This manual provides information about the MicroTech® Open Protocol Master (OPM) Panel. It describes the components, field wiring options and requirements, network commissioning procedures, and service procedures. The OPM Panel is used when integrating two or more MicroTech unit or auxiliary controllers into another company's building automation system (BAS).

For specific information about unit or auxiliary controllers, refer to the appropriate MicroTech controller installation manual (see Table 1). For installation and commissioning instructions and general information on a particular unit, refer to its model-specific installation manual.

Table 1. MicroTech Controller Installation Literature

	MicroTech unit or auxiliary controller	Installation & Maintenance Data bulletin number
	Series-100 centrifugal chiller	IM 403
	Series-200 centrifugal chiller	IM 616
	Reciprocating chiller	IM 493
	Screw chiller	IM 549
	Applied rooftop	IM 483
	Self-contained air conditioning	IM 608
	Series-100 unit ventilator	IM 509
	Series-300 unit ventilator	IM 613
	MicroTech Loop Water Controller	IM 431
①	MicroTech Absorption Gateway	IM 620
②	MicroTech Communications Gateway	IM 661

Notes:

1. The MicroTech Absorption Gateway (MAG) is an interface to McQuay absorption chillers, which use Sanyo controllers.
2. The MicroTech Communications Gateway (MCG) is an interface to McQuay water source heat pumps, which use MicroTech 2000™ controllers. When there are only MicroTech 2000 controllers, an MCG can substitute for an OPM Panel.

⚠ WARNING

Electric shock hazard. Can cause personal injury or equipment damage.

This equipment must be properly grounded. Connections and service to the MicroTech control panel must be performed only by personnel that are knowledgeable in the operation of the equipment being controlled.

⚠ CAUTION

Static sensitive components. A static discharge while handling electronic circuit boards can cause damage to the components.

Discharge any static electrical charge by touching the bare metal inside the control panel before performing any service work. Never unplug any cables, circuit board terminal blocks, or power plugs while power is applied to the panel.

NOTICE

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense. **McQuay International disclaims any liability resulting from any interference or for the correction thereof.**

Applying the OPM Panel

McQuay International has provided several BAS manufacturers licensed access to our MicroTech stand-alone controllers. This access, which is called Open Protocol™, allows a BAS to monitor status and change limited control parameters in McQuay International HVAC equipment. The result is a fully integrated BAS. *Note that an Open Protocol application does not always require an OPM Panel.*

When to Use an OPM Panel

Use an OPM to provide a single-point connection from a third-party BAS to a MicroTech network.

The OPM Panel should be used when there are two or more MicroTech controllers that need to be interfaced with a BAS by means of a single-point connection. (The maximum number of unit controllers per OPM depends on the BAS.) For example, the OPM Panel could combine a McQuay centrifugal chiller, a McQuay applied rooftop unit, and several AAF® unit ventilators into a network that a BAS could connect to with a single cable.

An OPM network can include any two or more of the following MicroTech controllers:

- Series-100 centrifugal chiller (old style)
- Series-200 centrifugal chiller
- Reciprocating chiller
- Screw chiller
- MicroTech Absorption Gateway (for McQuay absorption chillers)
- Applied rooftop unit
- Self-contained air conditioning unit
- Series-100 unit ventilator (old style)
- Series-300 unit ventilator
- Water source heat pump (old style)
- MicroTech Communications Gateway (for water source heat pumps with MicroTech 2000™ controllers)

The OPM acts only as a passive communications link between MicroTech controllers and the BAS. It does not perform any supervisory control for the various MicroTech controllers connected to it. Since all communications are handled by the OPM controller's operating system, its application software is virtually nonexistent. When an OPM is used, all supervisory control (e.g., scheduling, overrides, chiller sequencing) is handled by the BAS.

When Not to Use an OPM Panel

- Only one controller

  In a situation where there is only one MicroTech controller (for example, one centrifugal chiller), the OPM Panel is not required because a single controller can be directly connected to the BAS. This applies equally to every controller listed above in "When to Use an OPM Panel," including the MicroTech Absorption Gateway and the MicroTech Communications Gateway.

- Single-point connection not required

Some BAS companies do not require a single-point connection to multiple units. For example, they may be capable of providing a low-cost, separate connection to every unit ventilator controller in a building. In this instance, an OPM is not required.

- MCG and MicroTech 2000 controllers only

  If a BAS will be connected to a series of MicroTech 2000 controllers (and no MicroTech controllers), the MicroTech Communications Gateway (MCG) can substitute for an OPM. In this instance, an OPM is not required. (Since the MCG is considered a MicroTech controller and MicroTech 2000 controllers are not, this is just a specific "only-one-controller" application.)

- Supervisory control by McQuay

  In many cases, a BAS will perform supervisory control for the MicroTech unit controllers connected to it via an OPM; for example, the BAS may provide sequencing control for several chillers. However, this same control may be performed by a MicroTech network controller such as the CSC. In this instance, an OPM is not required. See "Alternatives to the OPM Panel" below.

Alternatives to the OPM Panel

Other level-1 MicroTech controllers can be used instead of an OPM. These controllers perform specific supervisory control, but cost more.

The following MicroTech network controllers, which perform specific supervisory control tasks, can substitute for the OPM Panel:

- Remote Monitoring and Sequencing Panel
- Remote Monitoring and Control Panel
- Chiller System Controller
- Lead-Lag/Load Balance Panel (obsolete)
- Chiller Plant Controller (obsolete)

Remote Monitoring and Sequencing Panel (RMS)

The RMS Panel networks up to three reciprocating or screw chillers. It provides remote monitoring and chiller sequencing control. For more information, see Bulletin No. IM 498.

Remote Monitoring and Control Panel (RMC)

The RMC Panel networks up to eight applied rooftop or self-contained air conditioning systems. It provides remote monitoring and multiple-unit control. For more information, see Bulletin No. IM 444.

Chiller System Controller (CSC)

The CSC networks up to four dual-compressor centrifugal chillers, up to eight single-compressor centrifugal chillers, up to eight reciprocating or screw chillers, or any combination of these that results in eight or fewer unit controllers. It provides remote monitoring, chiller sequencing control, chilled water temperature control, and auxiliary control for a variety of chiller plant equipment. For more information, see Bulletin No. IM 618.

Lead-Lag/Load Balance Panel (LLLB)

The LLLB Panel networks two single-compressor series-100 centrifugal chillers or the two compressor controllers on a dual-compressor series-100 centrifugal chiller. It provides compressor lead-lag and load balancing control. For more information, see Bulletin No. IM 425.

Chiller Plant Controller (CPC)

The CPC networks up to six series-100 centrifugal chiller (compressor) controllers. It provides chiller sequencing and cooling tower control. For more information, see Bulletin No. IM 433.

Loop Water Controller

For more on the LWC, see IM 431.

The MicroTech Loop Water Controller (LWC) provides loop water temperature and pump control for a water source heat pump system. The LWC can be included in an OPM network, *but we strongly*

discourage this practice. Instead, we recommend that the LWC be given a separate, dedicated connection to the BAS. The reason is that the BAS must coordinate loop water alarm control for the heat pumps regardless of how the LWC is connected. By providing a separate connection to the BAS, the response time can be speeded up significantly, reducing the risk of heat pump alarms, mechanical safety trips, or even equipment damage.

For example, if the loop pumps fail, the LWC will generate an alarm. The BAS must immediately detect this alarm and then send out a command to stop all heat pump compressors.

General Description

The MicroTech Open Protocol Master (OPM) Panel is a microprocessor-based controller that allows other MicroTech controllers to interface with a third-party building automation system (BAS). The OPM Panel is used when single-point entry is required to communicate with two or more MicroTech controllers. An IBM® compatible computer containing MicroTech Open Protocol Monitor™ software is used to commission the network. The Open Protocol Monitor software and license agreement must be purchased in addition to the OPM Panel.

All Open Protocol applications, including those using an OPM, require the purchase of an Open Protocol license agreement.

By using the OPM Panel as an interface, the BAS is able to perform the following supervisory functions for MicroTech unit and auxiliary controllers:

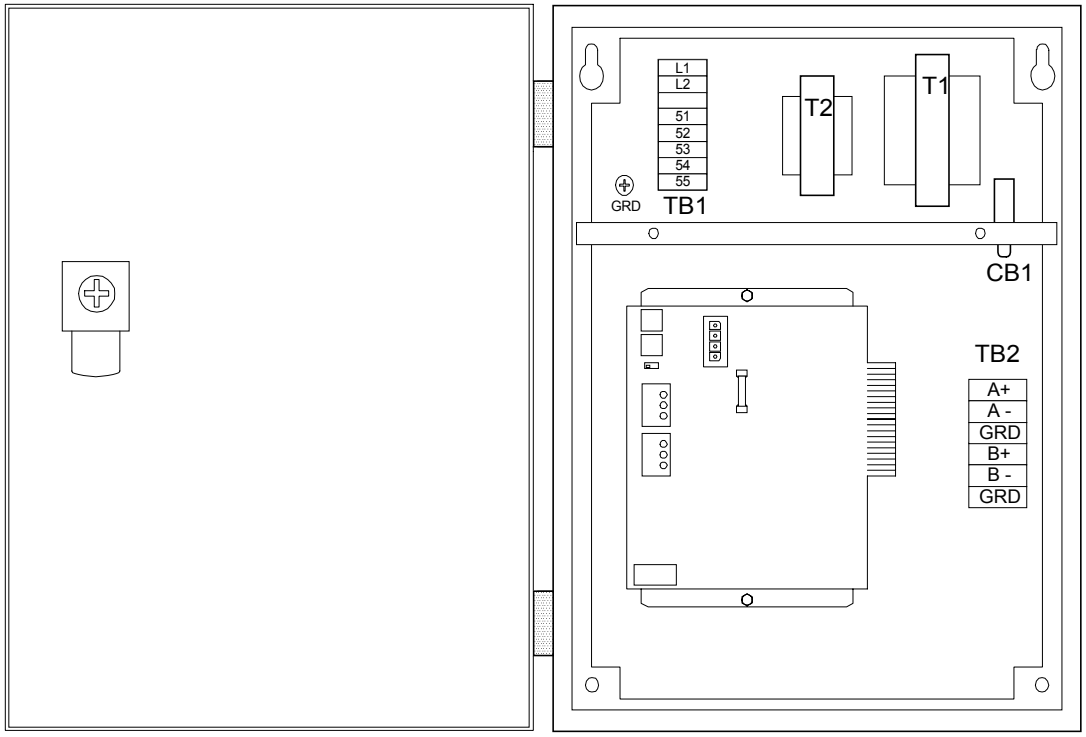
- Set the operating mode
- Monitor most controller inputs, outputs, setpoints, parameters, and alarms
- Set most controller setpoints and parameters
- Clear alarms

For details on specific parameters and capabilities, ask your McQuay International representative or Open Protocol partner company representative.

Component Data

Figure 1 shows the control panel layout for the OPM. The main component of the control system is the Microprocessor Control Board (MCB). On the MCB are hex switches, communication ports, LEDs, and a 1.5-amp fuse. Power to the controller is provided by transformers T1 and T2. Circuit breaker CB1, which provides overcurrent protection, can be used as an on-off switch for the panel. These components are mounted inside a NEMA 1 enclosure.

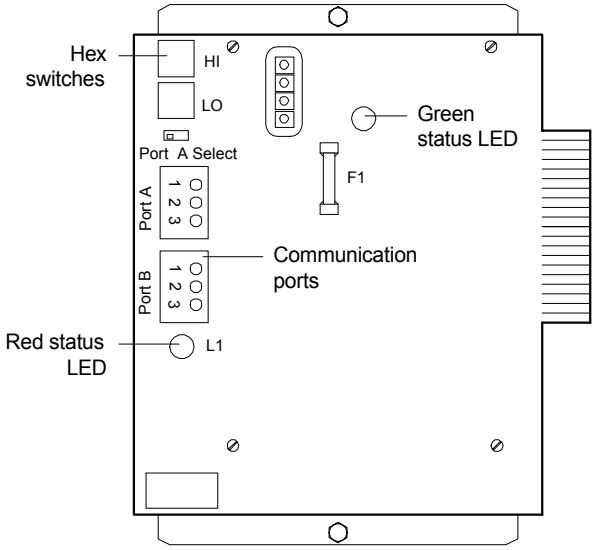
Figure 1. MicroTech OPM Panel Layout



Microprocessor Control Board

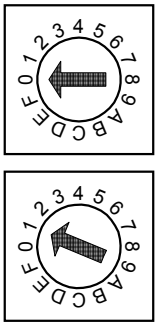
The Microprocessor Control Board (MCB) is shown in Figure 2. It contains a microprocessor that is preprogrammed with the software required to interface other MicroTech controllers with a third-party manufacturer's BAS. Located on the MCB are hex switches, communication ports, and status LEDs.

Figure 2. Microprocessor Control Board (MCB)



Hex Switches

The MCB includes two hex (hexadecimal) switches that are used to set the OPM Panel's network address.



Hex switches

A "hex switch setting" is defined as the HI switch digit followed by the LO switch digit. For example, a hex switch setting of 2F would have the HI switch set to "2" and the LO switch set to "F." The OPM Panel's hex switch setting should always be 00. See "About the Network Address" on page 15 for more information.

Note: You can change the setting of a hex switch with a slotted-blade screwdriver that has a $^{3}/_{32}$-inch tip. If a hex switch setting is changed, power to the MCB must be cycled in order to enter the new setting into memory. This can be done by opening and then closing the push-button circuit breaker (CB1) in the panel.

Communication Ports

The MCB has two communication ports: port A and port B. Each port has three terminals. The Port A Select switch, located below the hex switches, is used to select the RS-232C or RS-485 data transmission interface standard for port A. Moving the switch to the left sets up RS-232C and moving the switch to the right sets up RS-485. The ports have Phoenix-type connectors. Following are brief descriptions of each port's function.

Port A: Port A is for communications with the BAS using either RS-232C or RS-485. During OPM network commissioning and troubleshooting, port A is also used for communications with an IBM-compatible PC using RS-232C. The default communications rate is 9600 baud. For more information, see "PC Connection" on page 13.

Note: Remote connection with a BAS via modem is not supported.

Port B: Port B is for MicroTech network communications using RS-485. The communications rate is 9600 baud. For more information, see "Network Communications" on page 11.

Microprocessor Status LEDs

The green and red LEDs on the MCB provide information about the operating status of the microprocessor.

Following is the normal start-up sequence that the two status LEDs should follow when power is applied to the MCB:

1. The red ("Watchdog") LED turns on and remains on for approximately 5 seconds. During this period the microprocessor performs a self-test. (The red LED on the side of the bottom half of the MCB assembly performs the same indication.)
2. The red LED turns off and the green LED starts flashing, indicating that the OPM's program is active.

If the above sequence does not occur after power is applied to the controller, there is a problem with the MCB or its power supply. For more information, refer to the "Test Procedures" section on page 23.

Tables 2 and 3 summarize the red and green status LED indications.

Table 2. Red Status LED Indication

Red LED state	Indication
On*	Self-test failure or power supply problem
Off	MCB operating normally *or* no power to MCB

* For longer than 5 seconds

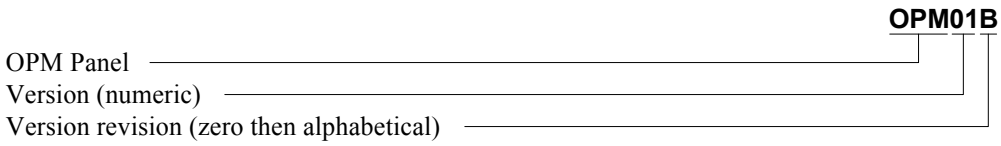
Table 3. Green Status LED Indication

Green LED state	Indication
Flashing (On 1 sec, Off 1 sec)	Normal operation
Off	Program inactive (checksums corrupt) *or* no power to MCB

Software ID

MicroTech OPM software is factory installed and tested in each panel prior to shipment. The software is identified by a program code (also referred to as the "Ident"). The program code is encoded in the controller's memory and is available for display on a PC equipped with Open Protocol Monitor software.

OPM program codification is as follows:



Panel Location and Mounting

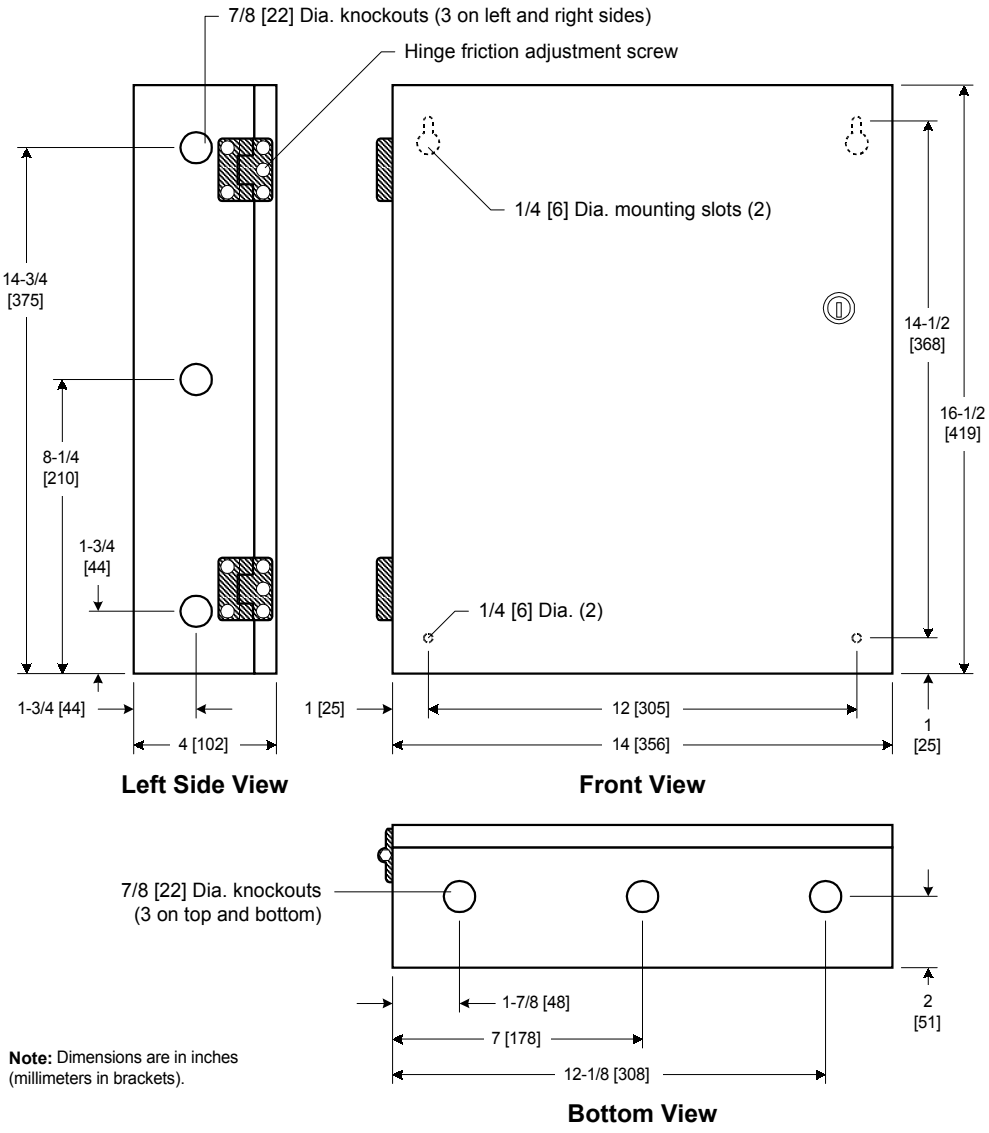
The OPM Panel is suitable for indoor use only. Table 4 lists the allowable temperature and humidity ranges. Locate the panel at a convenient height, and allow adequate clearance for the door swing. Mount the panel to the wall with screws or bolts. It weighs approximately 30 pounds (14 kg). Four ¼-inch openings are provided at the corners of the panel. Panel dimensions are shown in Figure 3.

The panel is equipped with special door hinges that have a friction adjustment screw. By adjusting this screw you can prevent the door from swinging open or closed unexpectedly.

Table 4. OPM Panel Environmental Specifications

Panel state	Temperature	Relative humidity
Operating	32 – 100°F (0 – 37°C)	0 – 95%, noncondensing
In storage	–40 – 140°F (–40 – 60°C)	0 – 95%, noncondensing

Figure 3. OPM Panel Dimensions



Field Wiring

Following are descriptions of the various field wiring requirements. A typical field wiring diagram is shown in Figure 4. Wiring must comply with the National Electrical Code and all local codes and ordinances. The warranty is void if wiring is not in accordance with these instructions.

Note that the panel is divided into high and low voltage sections by a sheet metal barrier. The power wiring should enter the high voltage section. The communications wiring should enter the low voltage section. Wiring penetrations must be made only through the 7/8-inch knockouts provided.

Power

⚠ WARNING

Electric shock hazard. Can cause personal injury or death.

This equipment must be properly grounded.

All protective deadfront panels must be reinstalled and secured when power wiring is complete.

The OPM Panel requires a 115 Vac power supply. The supply connects to terminals L1 and L2 in the high voltage section of the panel. The panel must be properly grounded by connecting the ground lug (GRD) to earth ground. Refer to Figure 4. Power wiring must be sized to carry at least 5 amps.

To gain access to the high voltage section, remove the deadfront barrier. It is attached to the panel with two 5/16-inch hex screws. Replace this deadfront when the wiring is complete.

The panel is internally protected by a 0.5-amp circuit breaker (CB1), which is located inside the panel on the underside of the high voltage section (see Figure 1 on page 7). This push-button circuit breaker can also be used as an on-off switch for the panel. When the push button is in, the panel is energized. When the push button is out, the panel is de-energized. Note that a white ring on the switch shaft is visible when the push button is out.

Network Communications

For network communications to occur, a twisted, shielded pair cable must be connected between the OPM Panel and its associated MicroTech unit or auxiliary controllers. This interconnecting, "daisy-chain" wiring is shown in Figure 4. Network communications is accomplished using the RS-485 interface standard at 9600 baud.

For the typical Open Protocol network, the OPM Panel is the level-1 controller and the unit controllers are level-2 controllers. In an Open Protocol network, there are no level-3 controllers except in the case of series-100 (old style) centrifugal chillers, which have a level-2 display processor and a level-3 unit controller.

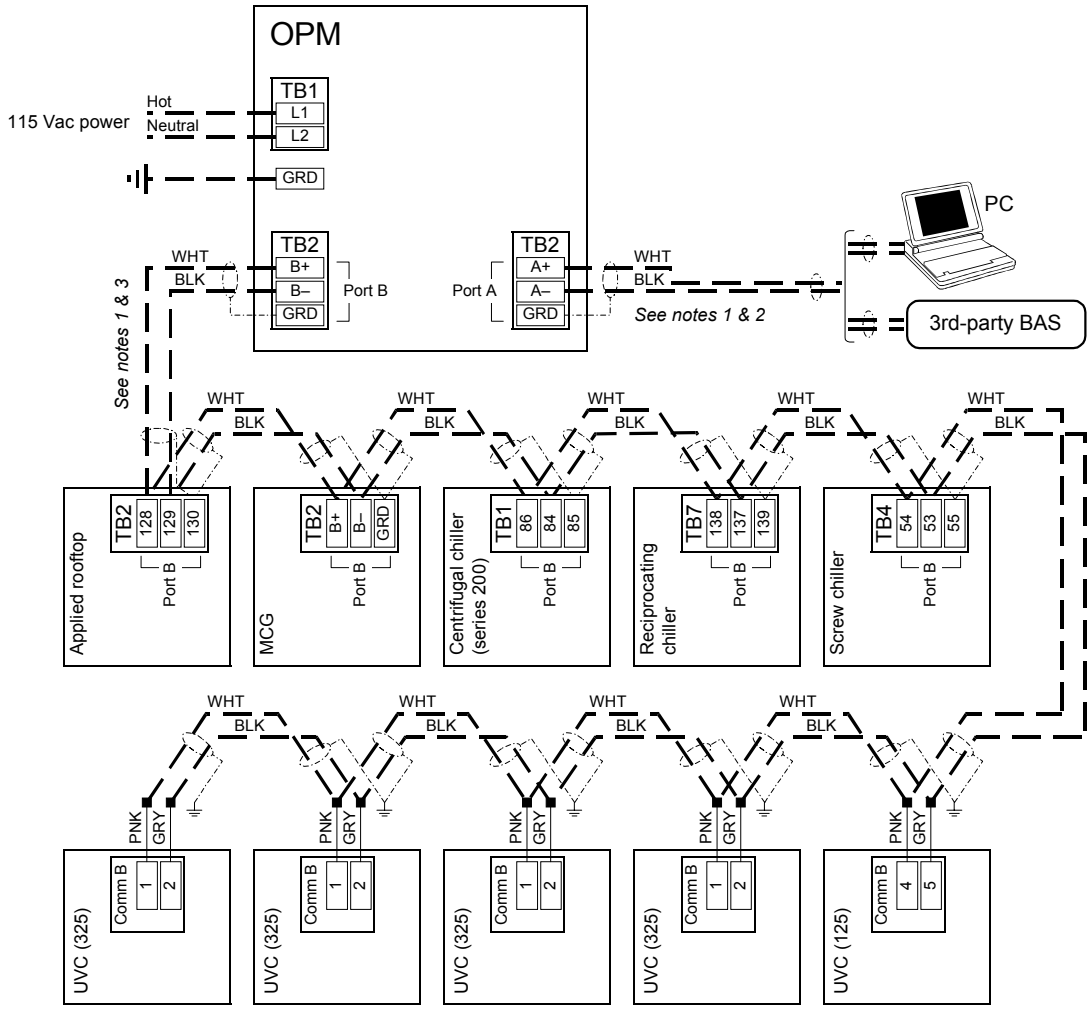
About MicroTech Network Architecture

All controllers in a MicroTech network are assigned a *level*: level 1, level 2, or level 3. All networks must have one level-1 controller to coordinate communications. Multiple level-2 controllers connect to the level-1 controller with a communications *trunk*. A trunk is defined as an isolated section of the daisy-chained network wiring. In Figure 4, the network wiring between all controllers is a trunk. Multiple level-3 controllers can be connected to a level-2 controller with a separate trunk; however, this is typically not done in Open Protocol applications. *The maximum allowable length of a communications trunk is 5000 feet.*

Cable Specification

The network communications cable must meet the following minimum requirements: twisted, shielded pair with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket (Belden 8762 or equivalent).

Figure 4. Typical Field Wiring Schematic



Notes:
1. Twisted, shielded pair cable must meet the following minimum requirements: 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket and drain wire (Belden 8762 or equivalent). Some local codes may require the use of plenum rated cable.
2. Cable length must not exceed 50 ft (15 m).
3. Cable length must not exceed 5000 ft (1524 m).

Legend

B+	Field wiring terminal
	Field wiring: discrete
	Field wiring: twisted, shielded pair cable with drain wire *(see note 1)*
	Factory wiring
■	Crimp or solder splice

Some local codes or applications may require the use of plenum rated cable. *Do not install the cable in the same conduit with power wiring*.

Note: Ideally, one continuous piece of cable should connect any two controllers. This will reduce the risk of communications errors. If the cable must be spliced, use crimp-type butt connectors (better) or solder (best). Do not use wire nuts.

Wiring Instructions

The network connection to the OPM Panel and level-2 controllers is at port B on their MCB boards.

As shown in Figure 4, field wiring to port B on these controllers can be accomplished by connecting the network cable to terminals B+, B–, and GRD in the OPM Panel and to the corresponding port B

terminals in each of the level-2 controllers. Refer to the product-specific installation and maintenance manuals to find the correct terminals.

Note that unit designations are established by the network address, not the physical position of the unit in the daisy chain. Thus the networked controllers can be wired in any order. However, *it is highly recommended that the installing contractor keep track of the physical order of the controllers on the daisy-chained trunk by preparing a schedule*. This will facilitate troubleshooting any network communications problems that may occur. For more on the network address, see "About the Network Address" on page 15.

To perform the network wiring

1. Before beginning, verify that the port B plug is disconnected from every controller on the communications trunk being wired. These plugs will be connected during the commissioning procedure. This is a precaution to prevent stray high voltage from damaging the controllers. Any voltage more than 12 V can damage the board's communications drivers.
2. Connect the network cable in a daisy-chain manner as shown in Figure 4. Use caution to ensure that the correct polarity is maintained at each controller. Be sure to connect each cable's shield to the controllers as shown in the figure. The positive (+), negative (–), and shield (ground) conductor must be continuous over the trunk.

Note: Refer to the product-specific installation and maintenance manuals to find the correct field wiring connections (see Table 1 on page 3).

PC Connection

PC connection to the OPM Panel (or its substitute) is required to commission the network (see the "Network Commissioning" section below). A laptop computer is ideal for network commissioning. Table 5 shows the specifications for the PC.

During network commissioning, the PC should normally be directly connected to port A on the OPM. Port A should be set up for RS-232 by setting the Port A Select switch above port A to "232." (If unit controller troubleshooting is required, the PC can also be directly connected to the A port on any properly configured level-2 controller.)

The OPM Panel's default port A communications rate is 9600 baud; however, it can be changed. See the "Controller Information Screen" sub-section of the *MicroTech Open Protocol Monitor Software User's Manual* for more information on changing the OPM's port configurations.

Direct Connection

An RS-232 communications cable kit that allows a PC to be directly connected to any MicroTech controller is available from McQuay International. The part number is 0057186802. The cable has a female DB-9 connector for connection to the PC's 9-pin serial port. (If the PC has a 25-pin serial port, obtain an adapter.) The cable length is 12 feet. If more length is required, a twisted, shielded pair cable can be spliced into the kit cable (see "Cable Specification" below). If this is done, splice the conductors with crimp-type butt connectors (better) or solder (best). Do not use wire nuts. *The maximum allowable cable length for direct connection between the PC and a controller is 50 feet.*

Cable Specification

A properly terminated, twisted, shielded pair cable is required to directly connect a PC to a MicroTech controller. The cable must meet the following minimum requirements: twisted, shielded pair with drain wire, 300 V, 60°C, 20 AWG, polyethylene insulated, with a PVC outer jacket (Belden 8762 or equivalent). It must also be properly terminated to an AMP or Phoenix plug on one end and a female DB-9 or DB-25 connector on the other. See Figures 5 and 6 for cable pinouts. The OPM uses a Phoenix-type connector. Several unit controllers and alternatives to the OPM Panel use an AMP-type connector. The McQuay part number for the Phoenix connector shown in the figures is 497590B-01. The AMP part numbers for the AMP connector shown in the figures are as follows: 1-480270-0 (plug) and 60617-1 (female pin terminals). Note that some local codes or applications

may require the use of plenum rated cable. Do not install the cable in the same conduit with power wiring.

Note: A factory-assembled cable that meets this specification is provided with the PC Communications Cable Kit, which is available from McQuay International. This cable has a DB-9 connector and an AMP plug. An AMP-to-Phoenix plug adapter is included. The kit part number is 0057186802.

Table 5. PC Specification

Preferred configuration	Minimum configuration
486DX processor, 66 MHz or better	386SX processor, 16 MHz
16 MB of RAM	4 MB of RAM
1 MB free space on hard disk or better	1 MB free space on hard disk
3½" floppy disk drive	3½" floppy disk drive
Serial port (9 pin male; COM1 or COM2)	Serial port (9 or 25 pin male; COM1 or COM2)
Internal time clock, battery backed	Internal time clock, battery backed
Super VGA graphics capability	VGA graphics capability
MS-DOS® 6.2 or higher	MS-DOS® 5.0
MicroTech® Monitor™ software for Open Protocol	MicroTech® Monitor™ software for Open Protocol

Figure 5. RS-232 Cable Pinouts for 9-Pin Serial Ports

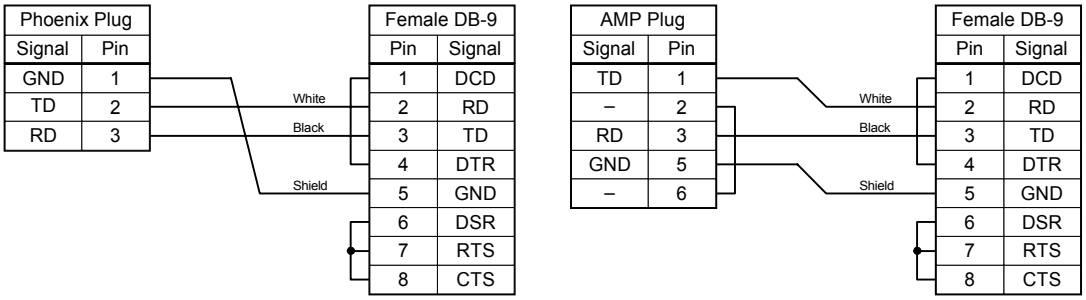


Figure 6. RS-232 Cable Pinouts for 25-Pin Serial Ports

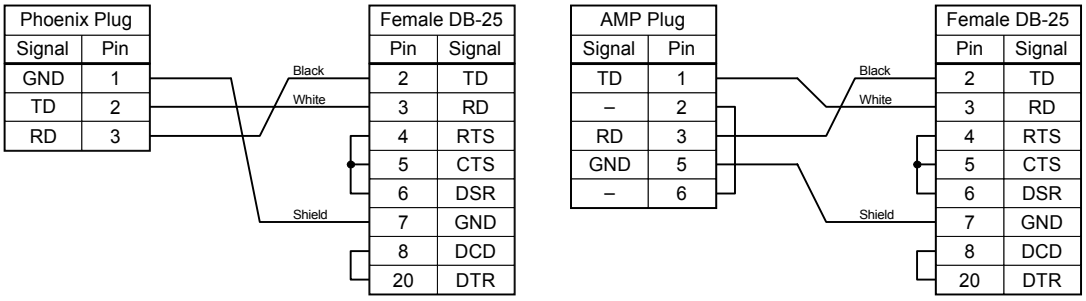
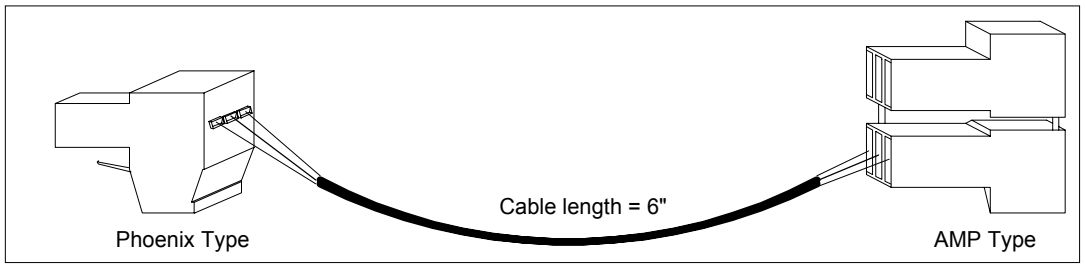


Figure 7. AMP-to-Phoenix Plug Adapter Cable



Network Commissioning

NOTICE

This section discusses the commissioning of a MicroTech network. Only personnel trained in MicroTech network commissioning procedures are allowed to commission a network. (This section is for review and guidance.) Network commissioning training classes are held periodically at McQuay International's Minneapolis location. Contact the Controls and Network Systems group for more information on network commissioning training classes and dates.

Unless special arrangements have been made, commissioning an Open Protocol network (i.e., the McQuay equipment including only the OPM or its substitute and all MicroTech unit or auxiliary controllers) is the responsibility of the McQuay sales representative, not the BAS company.

The purpose of network commissioning is to establish and verify communications between the OPM (or its substitute) and its networked MicroTech unit or auxiliary controllers. (It is not to establish and verify unit *operation*.) The network commissioning procedure is similar for all level-1 panels used in an Open Protocol environment when two or more unit controllers are included in the network. This commissioning section pertains to the OPM, but the procedures are similar for the RMS, RMC, CSC, LLLB, and CPC panels. For additional commissioning requirements of these OPM substitutes, refer to their installation manuals.

Network commissioning can be done independently of the unit commissioning procedures; however, *if it is done before the units are commissioned, care should be taken to assure that the units do not start.* Before any unit is allowed to operate, it must be commissioned in accordance with the instructions in the MicroTech unit controller installation literature (see Table 1 on page 3) and the model-specific unit installation literature.

Note: This section does not discuss the commissioning procedures for a MicroTech 2000 network. For information on that, see Bulletin No. IM 661, *MicroTech Communications Gateway*.

Required Tools

To commission the network, you need the following tools:

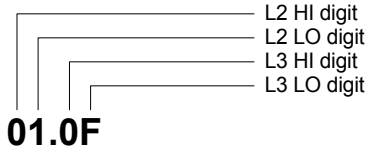
1. Voltmeter
2. Ohmmeter
3. PC equipped with Open Protocol Monitor software
4. Cable to connect the PC to a MicroTech controller

For more information on the PC and cable, see "PC Connection" on page 13.

About the Network Address

For network communications to occur, each controller in the network must have a unique network address. The network address has two parts: L2 address and L3 address. Each part is a two-digit hexadecimal number. For example, a unit at address "01.0F" has an L2 address of 01 and an L3 address of 0F (decimal 15). The first digit in each part is called the HI digit, and the second digit is called the LO digit. Thus for the L3 address 0F, the HI digit is "0" and the LO digit is "F." Table 6 is a hexadecimal to decimal conversion guide.

Figure 8. MicroTech Network Address



A controller's address is determined by its hex switch setting and its level in the network. The following table shows how the network address is defined.

When the controller is	The L2 address is	The L3 address is
Level 1	Always 00	Always 00
Level 2	The hex switch setting	Always 00
Level 3	Read from its level-2 master at power-up	The hex switch setting

After changing a hex switch setting, power to the MCB must be cycled to set the new address into memory. In the OPM and most other MicroTech panels, you can do this by opening and then closing circuit breaker CB1. In the unit controllers, this can be done in a variety of ways. Refer to the individual installation manuals for more information on cycling power to the unit controller MCBs. For more on hex switch settings, see "Microprocessor Control Board" on page 8.

Note: If any equipment is running, shut it down before removing power from the unit controller. Follow the shutdown procedures in the manuals listed in Table 1 on page 3.

Preparing an Address Schedule

In an Open Protocol application, the BAS uses the MicroTech network address for communications. Therefore, *the first step in commissioning the network is to talk to the BAS company and decide who will assign the addresses.* Whoever assigns the addresses should prepare a schedule indicating what the hex switch setting for each controller should be. If the schedule is prepared by you, you should give a copy to the BAS engineers so they can set up the BAS software. If the schedule is prepared by the BAS engineers, you should obtain a copy so you can set the addresses and commission the network.

Note: If BAS company personnel prepare the address schedule, they must be aware of and follow the addressing rules, which are given below.

The system engineer should keep in mind the following rules when preparing the address schedule:

- The level-1 controller (usually an OPM) always has a hex switch setting of 00 (address 00.00).
- The L2 addresses of level-2 MicroTech controllers must start at 01 and continue consecutively (in hex) up to the limitation of the BAS.
- There must be no gaps in the address sequences and no duplicate settings.

As long as these rules are followed, a MicroTech controller's network address can be set to any value.

Projects With Two or More OPM Panels

If a project has two or more OPMs, the networks associated with them should be separate and independent. The BAS will then have separate connections for each OPM Panel. Each network must follow the addressing rules listed above. (The BAS will be able to distinguish between multiple units with the same MicroTech address as long as they are on separate MicroTech networks.)

For example, assume that a project includes 100 MicroTech-equipped unit ventilators and the BAS limitation is 64 controllers. Sixty-four unit ventilators connect to OPM "A," and 36 unit ventilators connect to OPM "B." One possible addressing scheme is as follows:

Hex switch setting	Controller
00	OPM “A”
01	Unit ventilator 1 on OPM “A” network
02	Unit ventilator 2 on OPM “A” network
03–40	Unit ventilators 3 through 64 on OPM “A” network
00	OPM “B”
01	Unit ventilator 1 on OPM “B” network
02	Unit ventilator 2 on OPM “B” network
03–24	Unit ventilators 3 through 36 on OPM “B” network

Table 6. Hexadecimal to Decimal Conversion Guide

Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
01	1	11	17	21	33	31	49
02	2	12	18	22	34	32	50
03	3	13	19	23	35	33	51
04	4	14	20	24	36	34	52
05	5	15	21	25	37	35	53
06	6	16	22	26	38	36	54
07	7	17	23	27	39	37	55
08	8	18	24	28	40	38	56
09	9	19	25	29	41	39	57
0A	10	1A	26	2A	42	3A	58
0B	11	1B	27	2B	43	3B	59
0C	12	1C	28	2C	44	3C	60
0D	13	1D	29	2D	45	3D	61
0E	14	1E	30	2E	46	3E	62
0F	15	1F	31	2F	47	3F	63
10	16	20	32	30	48	40	64

OPM Controller Setup

Tip: *Have the* MicroTech Open Protocol Monitor Software User’s Manual *available when performing the commissioning procedure.*

A PC equipped with Open Protocol Monitor software is required to set up the OPM controller. The first step in doing this is to connect the PC to it.

Connecting the PC to the OPM

Unplug the OPM’s Phoenix plug from port A (if necessary), and connect the PC communications cable to it. If you’re using the cable from the PC Communications Cable Kit, connect the AMP-to-Phoenix adapter first (see Figure 7 on page 14).

To use the PC, it must have the Open Protocol Monitor software loaded. See Chapter 1, “Setting Up the Monitor Program,” in the *MicroTech Open Protocol Monitor Software User’s Manual* for information on installing the software.

Establishing Communications

When the PC is connected and the OPM Panel is powered up, perform the “Establishing Communications” procedure in Chapter 2, “Running the Open Protocol Monitor Program,” of *the MicroTech Open Protocol Monitor Software User’s Manual*. Communications between the PC and the OPM can be established when the Monitor program is started or after it is started.

Setting Parameters in the OPM

Setting up the OPM’s parameters consists of two procedures. The first procedure is to set up the number of level-2 slaves with the Open Protocol Monitor software. The second procedure is to

correct the Program Checksum to match the EOS Checksum. The “Controller Information Screen” section in the *Open Protocol Monitor Software User’s Manual* explains how to change the number of level-2 slaves and the Program Checksum.

The number of level-2 slaves must be set to match the quantity of MicroTech unit or auxiliary controllers connected to the network. If the number entered into the Monitor software is less than the actual quantity of controllers in the network, you will not know if all the controllers are communicating properly with the OPM Panel.

When the number of level-2 slaves is changed, the Program Checksum’s value must also be changed. The Program Checksum needs to match the EOS Checksum so that the controller program will operate.

About Checksums

Checksums are used by the MCB to verify the integrity of its program. If the Program Checksum does not match the EOS Checksum after a reset occurs, the program will stop running. The Program Checksum is adjustable; the EOS Checksum is not.

Some variables—for example, Number Of Slaves—cause the EOS Checksum to change when they change. Therefore, if you change one of these special variables, you must then (1) reset the MCB, (2) set the Program Checksum equal to the EOS Checksum, and (3) reset the MCB again.

Connecting the Level-2 Trunk

Use the following three procedures to commission the level-2 trunk.

Procedure 1: Communications Cable Check

The network communications cable should have been installed in accordance with the instructions in the “Field Wiring” section of this manual. This procedure will verify that there are no shorts or stray voltages anywhere in the communications trunk.

Before beginning, verify that the port B connectors are disconnected from every controller on the trunk.

1. Verify that there is no voltage between any conductor and ground.

   Use a voltmeter to test for voltage at the field wiring terminal block or directly on the port B connector (not the port itself) of the level-1 controller (OPM or substitute). With one lead on the control panel chassis (ground), check for voltage at the “+,” “–,” and “ground” terminals. There should be no AC or DC voltage (see the Signal and Terminal columns of Table 7 on page 20). If the conductors are properly terminated, this check will test for stray voltage throughout the trunk.

   If you get a 2 or 3 Vdc reading, it indicates that one or more powered controllers are connected to the trunk. These controllers should be located and disconnected.

2. Verify that there are no shorts between any two conductors.

   Use an ohmmeter to test for shorts at field wiring terminal block or directly on the port B connector of the level-1 controller. For the three combinations of conductor pairs, there should be infinite resistance between the conductors. If the conductors are properly terminated, this check will test for shorts throughout the trunk.

   If you find a resistance that is high but less than infinite, it indicates that one or more non-powered controllers are connected to the trunk. These controllers should be located and disconnected.

3. Verify that the communications wiring is continuous over the trunk and that the field terminations are correct. (This step is optional but recommended; to do it, you must know the physical layout of the network’s communications trunk.)

Go to the last controller on one end of the daisy-chain and place a jumper across the "+" and "–" terminals. Then go to the last controller on the other end of the daisy-chain and use an ohmmeter to test for continuity across the "+" and "–" terminals.

Remove the jumper and repeat this step for the other two conductor pairs: "+" to "ground" and "–" to "ground."

If there is continuity for each conductor pair, the wiring is continuous and it is likely (but not guaranteed) that the terminations are correct throughout the trunk.

If there is no continuity for one or more conductor pairs, there may be a break in the trunk or the terminations at one or more controllers may have been mixed up.

Procedure 2: OPM Connection

The OPM (or its substitute) is connected to the trunk first so that the PC can communicate with the level-2 controllers when they are connected.

1. Set the OPM's hex switches to 00 (level 1). See "About the Network Address" above for more information.
2. Push the circuit breaker (CB1) button to power up the OPM and verify that there is power to the MCB by observing the LEDs.
3. Check the voltages of port B directly on the port.

   Use a DC voltmeter to test for proper voltages. With the ground lead on the control panel chassis (ground), check the voltage at the "+," "–," and "ground" terminals. Refer to Table 7 for the correct voltage levels.

   If no voltage or improper voltage levels are found, verify that the panel is energized.
4. Plug the network communications connector (Phoenix or AMP plug) into port B.

Procedure 3: Level-2 Controller Connection

This procedure will verify that proper communications have begun for each controller as it is connected to the network. You can connect the level-2 controllers in any order; however, it is better to follow the daisy-chain as you proceed. This will make troubleshooting easier if communications problems occur.

Note: To verify communications more quickly and easily, use two people to commission the network. When there are two people, one person can stay at the PC connected to the OPM and the other person can go to each individual unit controller. Using a set of radios or other two-way communication equipment, you can tell each other when a specific controller is connected and whether communications between the controllers is occurring.

As a result of the previous procedures, the network communications connector should be disconnected from the B port at every controller on the trunk except for the OPM. Be sure that this is true before beginning this procedure.

For communications to occur, each networked controller must have the proper hex switch setting and the proper voltages at its port B terminals.

1. Set the network address (hex switch setting) to match the address on the engineering schedule. Each controller must have a unique address.
2. Turn on power to the level-2 controller. Refer to the controller installation manuals for information on how to turn on power to each controller. (If the power was already on, turn it off and then on again to set the network address into memory.)
3. Check the voltages of port B directly on the port. The trunk must *not* be connected to the controller when you do this.

   Use a DC voltmeter to test for proper voltages. With the ground lead on the control panel chassis (ground), check the voltage at the "+," "–," and "ground" terminals. Refer to Table 7 for the correct voltage levels.

If no voltage or improper voltage levels are found, verify that the controller is energized.

4. Check for proper communication trunk voltages at the field wiring terminals (if any) or directly on the connector. The trunk must *not* be connected to the controller when you do this.

   If no voltage or improper voltages are found, check the wiring between the port terminals and the field terminals (if any). Using Table 7 and Figure 9, 10, or 11, verify that the three conductors are properly terminated in the network communications connector. If there is still a problem, verify that the level-1 controller is energized and that the communications trunk wiring is intact.

5. Plug the network connector into port B.
6. Verify that communications have begun between the OPM and the level-2 controller.

Using a PC running Open Protocol Monitor™ software, perform a network diagnostic. For information, see the "Performing Network Diagnostics" section in the *MicroTech Open Protocol Monitor Software User's Manual*.

You can choose to continually loop the network scan, to have a single network scan, or to scan for a specific controller. It is most convenient to use the "Loop" option, but any method will work. As the different controllers are connected to the network, their information is displayed on the Network Diagnostic Error Display screen. By looking at the headings labeled "Address" and "Error Code," network communications to a particular controller can be verified. If there are no error codes, network communications to the controller was successful. If the "Error Code" reads "Does Not Respond," a communications problem has occurred.

If a communications problem occurred, check the following:

- Make sure the hex switches on each controller are set to the correct values.
- Make sure the controller has power supplied to it.
- Make sure the communication line is properly connected to port B.
- Make sure the controller is level 2 by directly connecting the PC to it.

1. Go to the next controller and repeat steps 1 through 6. Do this for each controller being connected to the network. *Communications must be established between the OPM and every controller on its network before the network is turned over to the BAS personnel.*
2. When communications to all the unit controllers on the network have been verified, the OPM's Number Of Slaves variable needs to be set back to zero. This will speed up communications for the BAS. See "Setting Parameters in the OPM" on page 17 for information on how to do this.
3. At this point, the PC can be disconnected from the OPM's A port and the BAS can be connected.

Note that some BASs use RS-485. If this is the case, the Port A Select switch should be placed in the "485" position.

In addition to verifying network communications between the OPM and its level-2 controllers, you have also verified that a PC can connect to the OPM through port A with the communications password shown on the Monitor screen. The BAS should use this same password. If the BAS cannot connect using this password, there is likely a problem on the BAS side, not the McQuay side.

Table 7. Port B Voltages

Port B (RS-485)					
Signal	**Phoenix terminal**	**AMP terminal**	**IDC (325) terminal**	**IDC (125) terminal**	**Acceptable voltage reading**
+	2	4	1	4	3.0 ± 0.3 Vdc
–	3	3	2	5	2.0 ± 0.3 Vdc
Ground	1	5	3	6	0.0 ± 0.2 Vdc

Figure 9. Phoenix Connector Terminal Configuration

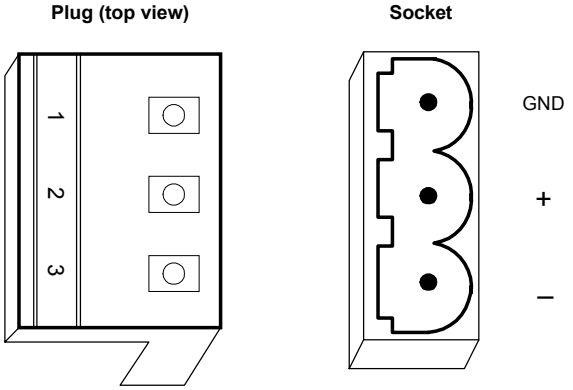
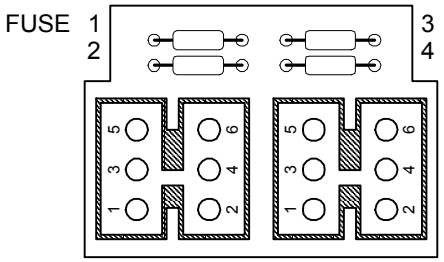
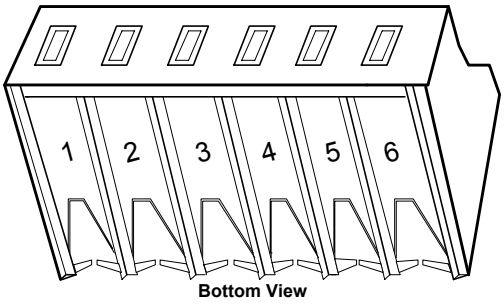


Figure 10. AMP Connector Terminal Configuration



[FUSE: BUSSMAN MCR-1/4]

Figure 11. IDC Connector Terminal Configuration



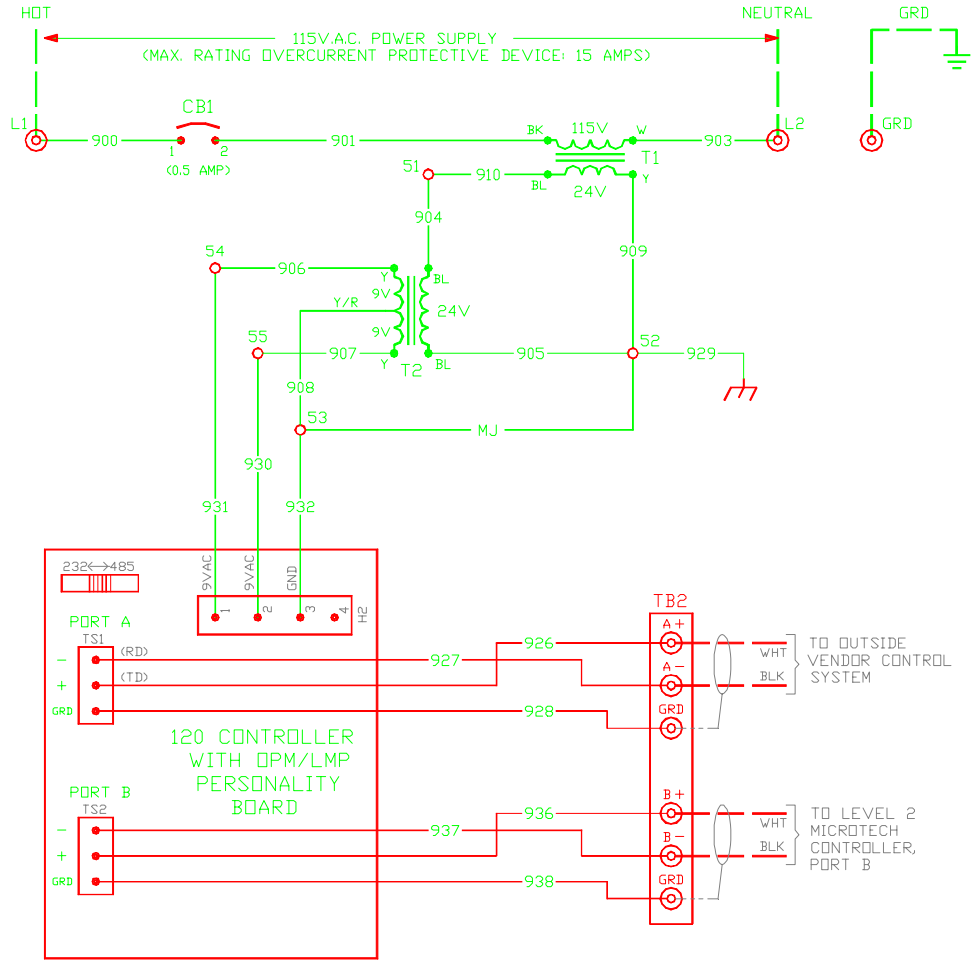
Wiring Diagram

The following wiring diagram is identical to the one in the OPM Panel. It is reproduced here for your convenience. The legend is shown in Table 8.

Table 8. OPM Panel Schematic Legend

Component designation	Description
CB1	Circuit breaker
MCB.....	Microprocessor Control Board
T1	Transformer: 115/24 Vac
T2	Transformer: 24 Vac/18 Vac-CT
TB2	Terminal block: low voltage section
—911—	Factory wire number
	Field wiring terminal
	Field wiring
	Printed circuit board terminal
	Twisted, shielded pair cable

Figure 12. OPM Panel Schematic



Test Procedures

A listing of MicroTech related part numbers is included on page 24. If the MCB must be replaced, see page 24.

LED Diagnostics

The MCB LED indications can aid in controller diagnostics. If the status LEDs do not operate normally as described in the "Component Data" section of this manual, there is a problem with the MCB. Following are troubleshooting procedures for the various symptoms.

Red LED Remains On

If the red LED remains on after the 5-second self-test period, it is likely that the MCB is defective. This also can occur in some instances if there is a power supply problem. Refer to "Troubleshooting Power Problems" below.

Red and Green LEDs Off

If all the LEDs do not turn on after power is applied to the controller, there is likely a defective component or a problem in the controller's power distribution circuits. Refer to "Troubleshooting Power Problems" below.

Troubleshooting Power Problems

The MCB receives 18 Vac, center-tapped power from transformer T2. Power problems can be caused by a defective component, which can either blow a fuse or create an excessive load on the power supply. An excessive load can lower the power supply voltages to unacceptable levels. Use the following procedure to isolate the problem. Note that this procedure may require a spare MCB fuse (see parts list). Refer to the panel wiring diagram.

1. Verify that circuit breaker CB1 is closed.
1. Remove the MCB power connector and check for 9 Vac between terminals 2 and 3 on the plug. Then check for 9 Vac between terminals 1 and 3 on the plug. (Readings of 9–12 Vac are acceptable.)

   If 9 Vac is present between both sets of terminals, go to step 3.

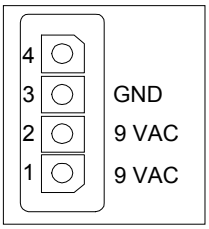
   If 9 Vac is not present between either set of terminals, check transformers T2 and T1 and all wiring between the 115 Vac source and the MCB power connector.
2. Remove power from the controller by opening circuit breaker CB1. Check the MCB power supply input fuse (F1) with an ohmmeter. A good fuse will have negligible resistance through it (less than 2 ohms).

   If the fuse is blown, replace it. Go to step 4.

   If the fuse is intact, the MCB is defective.
3. Reconnect the MCB power connector. Cycle power to the controller (close and then open CB1) and check the power fuse again.

If the fuse is blown, the MCB is defective.

If the fuse is intact, the problem is indeterminate. Obtain factory service.



MCB power connector

Troubleshooting Communications Problems

Troubleshooting communications problems is limited to the following:

- Checking the port B voltages
- Checking the network wiring integrity
- Checking the network addressing

The best way to accomplish these checks is to perform the start-up procedures in the "Network Commissioning" section of this manual. If these procedures have been performed and the problem persists, obtain factory service.

MCB Replacement

If an MCB board is defective and must be replaced, the proper controller software must be loaded into the replacement MCB. This can be done either at the factory or at the building site with a PC running Open Protocol Monitor software.

The factory will download the proper controller software into a replacement MCB board before it is shipped if you include the OPM controller's program code with the replacement MCB part order. If the program code is not provided, the MCB board will be shipped without software.

Parts List

Component designation		Description	Part no.
MCB	①	Microprocessor Control Board	677811B-01
T1		Transformer: 115/24 Vac	606308B-01
T2		Transformer: 24/18 Vac, center tapped	467381B-14
CB1		Circuit breaker	7350733-03
F1		Fuse: MCB input power, 1.5 A (Bussman No. GDC-1.5A)	658296A-01
–		PC Communications Cable Kit	0057186802

Notes:

1. If desired, the factory can download the correct software into the replacement MCB prior to shipment. See the "MCB Replacement" section above for more information.